REMARKS

A. Introduction

In the April 27, 2004 Office Action, claims 1-9 are noted as pending and are rejected based on prior art.

In this Response, claims 1 and 7 are amended (claim 7 just to correct spelling) and remarks are provided.

B. Counter-Signed PTO 1449

The undersigned appreciates the Examiner's attention to the request to return the initialed PTO 1449 filed on July 2, 2003 with an Information Disclosure Statement. The indication of "ten" references in the February 19, 2004 Response related to the nine references listed on the PTO 1449 and the Search Report referenced in item 1c attached to the IDS. The undersigned regrets any confusion.

C. Grounds for Entry of this Response Pursuant to 37 C.F.R. 1.116

Applicant requests entry of this Rule 116 Response because: (a) it is believed that the amendment of claims 1 and 7 puts all pending claims into condition for allowance; (b) the Applicant believed in good faith that the cited art did not disclose the present invention as previously claimed; and (c) the amendment of claims 1 and 7 should not entail any further search by the Examiner since no new features are being added or new issues being raised.

D. The Present Invention

The following summary is to assist in the examination of the present invention, but is not intended to limit the scope of the claims.

The present invention relates to a stack of objects, each of which has an identical 3-D shape (e.g., flanged cylinders as shown in Figs. 1 and 2), but different positions and postures (see again Fig. 1, the workpieces W piled randomly on top of one another).

The invention also pre-stores parameters of various "reference models", based on an

image capturing device (camera) viewing a "reference object" (either one of the actual stacked objects or an object having the same 3-D shape as one of the stacked objects) oriented in various angular rotations (see Figs. 2a-d of the application).

Further, the image capturing device views the stacked objects and, for an "object of detection", i.e., one of the objects to be picked up, a processor compares the image of a stacked object being viewed against the reference models to select the corresponding reference model, which yields the posture and position of the actual object in the stack to facilitate pick-up.

Thus, in contrast to the prior art which has, from a practical point of view, required manual picking of objects from a randomly arranged stack, the present invention allows accurate detection and automated picking up of a detected object for further processing. See pages 1 and 2 of the present application.

E. Rejection of Claims 1-9 Under 35 U.S.C. §103

These claims are rejected as being made obvious by a combination of U.S. Patent No. 4,680,802, of Nishida et al. and U.S. Patent No. 6,026,189, of Greenspan.

For the following reasons it is respectfully submitted that the present invention, as recited by amended claims 1-9, was not rendered obvious by the cited combination.

Nishida et al. relates to the use of the four parameters shown in Fig. 4 thereof for determining "types" and postures of two-dimensional component parts supplied on a rotary parts feeder 1 (Fig. 1). However, this reference fails to teach or disclose the use of reference models created based on image date of a three-dimensional object captured in different directions for determining posture, or posture and position of the three-dimensional object by performing matching processing, which appears to be admitted in the Action.

More particularly, Nishida et al. seeks to identify two-dimensional objects (see, e.g., Fig. 4 of this reference and Col. 5, lines 8-17) moving on the feeder 1 using the four parameters (hole position, major axis direction, remotest point and ultimate value pattern), in various combinations

to create eight "types" (kinds) and postures of the two-dimensional shapes. Essentially, by a process of elimination, the various pre-stored parameters are compared against detected image characteristics so that the detected image can be corresponded with the closest set of parameters.

Nishida et al. does not include at least the recited plurality of stacked, three-dimensional objects. Also, the objects of Nishida et al. do not appear to be of identical shape, but appear to be arbitrary shapes. See, e.g., Col. 1, lines 38-41 and Col. 5, lines 8-10. Further, Nishida et al. does not create "reference models" and store data regarding these reference models by angularly rotating a reference object, which has the identical 3-D shape as the 3-D stacked objects. While Nishida et al. indicates that the "directions of the component parts must be known in order that the assembly robot 5 can pick them up" (Col. 2, lines 25-27), this direction is not the intentional use of a reference object whose angular rotation is measured by the image capturing device/processor.

The present invention is able to detect the image of a single object within a stack of objects (page 1, lines 7-8,10-11 and 16-17), unlike Nishida et al. The method of the present invention can be applied to objects overlapped with each other by adopting appropriate matching processing. The posture judgment method of Nishida et al. would not be applied by one of ordinary skill to objects overlapped with each other. This reference can only detect the image of an object if it is spaced from other objects so that the parameters shown in Fig. 4 thereof can be clearly seen and detected. Put in another way, the present invention can work even if there is overlap of one object by a portion of another, whereas Nishida et al. can only work if the object does not overlap with any other object.

Thus, the issue under Graham v. John Deere is whether one of ordinary skill would have been taught by Greenspan et al. to modify Nishida et al. to arrive at the present invention. It is respectfully submitted that the answer is no.

Greenspan does relate to three-dimensional processing. However, this reference does not rely upon identically shaped stacked objects, does not create a plurality of reference models (which is basically one of the identical shapes in various angular rotation positions), does not store these reference models and then compare the image of an object of detection (i.e., one of the stacked objects to be picked up by the robot) with the reference models and chose the closest reference model, and does not rely upon the data associated with the chosen reference model to command the robot to pick up the object of detection. Thus, one of ordinary skill would not consider it feasible to combine the three-dimensional features of Greenspan with the two-dimensional method of Nishida et al.

More particularly, Greenspan discloses recognition of a three-dimensional image of an object using a plurality of cells called "voxels", which are regular grids of cubic volume elements, as shown in Fig. 1 thereof. The voxels are used to form a tree structure analysis. Col. 8, lines 35-36. Greenspan, like Nishida et al. relies upon extracted features of the objects, butuses the decision tree classifier which "incrementally queries a range of image for surface data." See, e.g., Col. 5, lines 56-57. In contrast, Nishida et al.'s method includes only two-dimensional objects classified by geometry features to determine classification to which the object belongs, and the position/orientation which the object takes using a simple formula.

As seen in Figs. 7-11, Greenspan does not relate to the use of a plurality of identically-shaped 3-D objects, nor does it propose taking an object of identical shape and angularly rotating it for the purpose of teaching the processor a plurality of reference models for which matching processing can be used to then pinpoint and pick up an object of detection that has been compared against the reference models. Since Greenspan does not even relate to the use of "reference models" as recited, its applicability to Nishida et al. is simply questioned.

Thus, the teachings/guidance of the respective references are quite different from each other and thus could not be properly combined.

III. CONCLUSION

In light of the above amendments and remarks, it is respectfully submitted that claims 1-9 are now in condition for allowance.

If there any additional fees associated with filing of this Response, please charge the same to our Deposit Account No. 19-3935.

Finally, if there are any formal matters remaining after this Response, the undersigned would appreciate a telephone conference with the Examiner to attend to these matters.

Respectfully submitted,

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